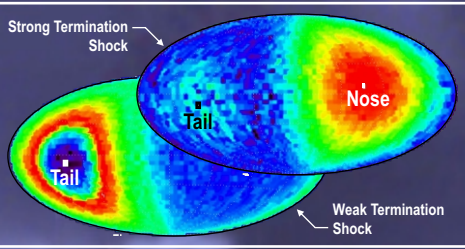
HELIOSPHERIC IMAGER AND GALACTIC OBSERVER - HIGO

Our first step into the interstellar medium and a window into galactic evolution

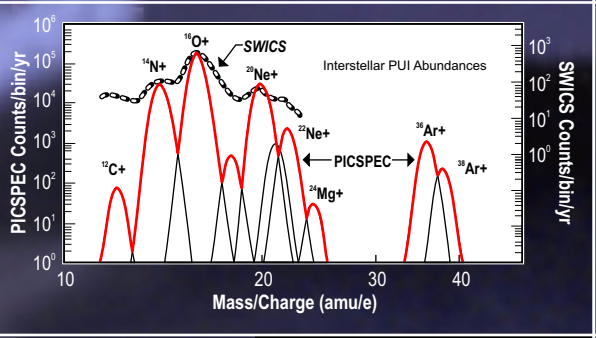
Energetic Neutral Atoms (ENAs)



Global ENA images reveal global strength of termination shock. Shown here are simulated extremes of a strong and weak TS.

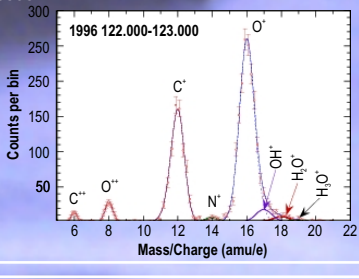
Interstellar Pickup Ions

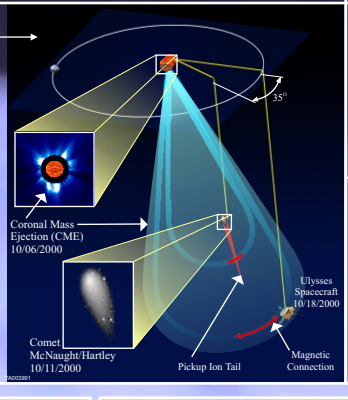
- High FIP Elements (Ne, He, N, ^{3}He, H, O)
- H ionization cavity < 3-4 AU
- He ionization cavity < 0.5 AU



Cometary Pickup Ion Tails

- Comet Hyakutake event observed by Ulysses
- Comet McNaught-Hartleyevent observed by Ulysses





SCIENCE OBJECTIVES	MEASUREMENT STRATEGY
• Image the global interaction between the interstellar medium and the solar wind that forms the global heliosphere and its boundaries	• Image the termination shock using global sky maps of ENAs • Image the heliopause using global sky maps of 83.4 O+
• Determine the Nucleosynthetic Status of a Present-Day Sample of the Galaxy and Explore the Implications of this Knowledge for Big Bang Cosmology, Galactic Evolution, Stellar Nucleosynthesis, and the Birthplace of the Sun • Characterize the physical state the local interstellar cloud	• Determine isotopic and elemental composition of the neutral portion of interstellar gas from measurements of pickup ions and main neutral species • Determine flow direction, speed and temperature of interstellar atoms
• Search for molecules and the building blocks of life liberated by sublimation of small comets, asteroids and grains (detectable through measurement of pickup particles)	• Composition of pickup ions in tails from comets, asteroids, and grains
• Explore how particles are injected and accelerated at strong shocks in the inner heliosphere • Contribute to our understanding of the 3-D heliosphere by monitoring the evolution of the solar wind beyond Earth's orbit	• Solar wind, magnetic fields, energetic particles, radio, and plasma observations

MISSION DESCRIPTION

Launch: 2012
- C_3 = 27.17 km^2/s^2 (max)

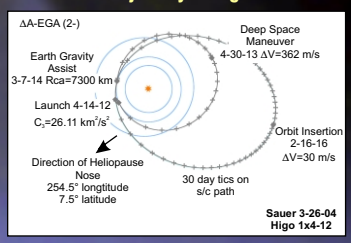
Trajectory
- DV-EGA (2-)
- Science OPS Orbit:
  - * 1 x 4 AU Equatorial
  - * Primary collection:
    - 3 AU outbound to
    - 3 AU inbound

Delta II (3-stage) Launch Vehicle Family Selected
- Delta II 2925-9.5 Selected as BASELINE Launch Vehicle
- Delta II 2925-9.5 Available as Higher Performance Option

Payload Accommodations
- Total Mass: 81.9 kg
- Total Power: 60.2 W (avg)
- Average Data Rate: 1 kbps@ >2AU

Data Strategy
- Weekly return of science data: 1 DSN pass/week, 8-hour duration (or less)

Trajectory Design



Launch Vehicle Performance

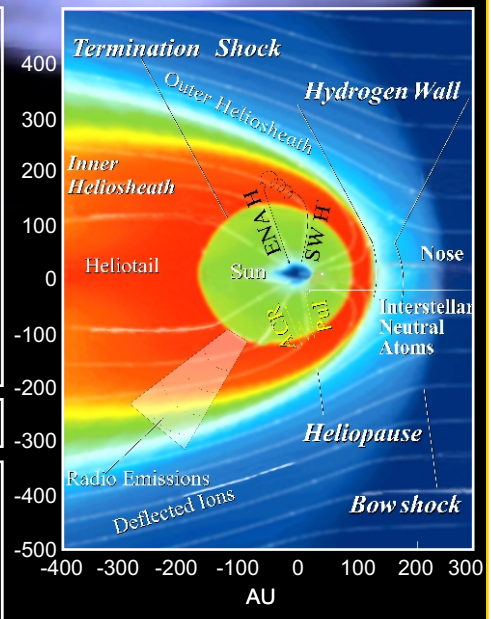
NO NEW TECHNOLOGICAL DEVELOPMENT REQUIRED

- Propulsion technology at hand
  - Composite pressure tanks are routinely used
  - Composite propellant tanks have been flown and should be routine by tech cut-off
  - Current technology Titanium tanks available as back-up
- Advanced transponder in development, scheduled for availability in '07-'08 time frame
  - Small Deep Space transponder available as back-up

LOW RISK MISSION

- Science instruments have possibility for additional impacts to F/S design
- Neutral Imager scans can impact ACS
- Important to maintain IDPU as high reliability design with internal redundancy

THE HELIOSPHERE



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JPL

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HIGO Science Context

STRATEGIC SCIENCE OBJECTIVES (SEC)

- Understand the changing flow of energy and matter throughout the Sun, heliosphere, and planetary environments
- Explore the fundamental physical processes of space plasma systems
- Define the origins and societal impacts of variability in the Sun-Earth connection

ADDITIONAL SCIENCE OBJECTIVES

- Understand the structure of the universe, from its earliest beginnings to its ultimate fate
- Learn how galaxies, stars, and planets form, interact, and evolve
- Understand the formation and evolution of the solar system and Earth within it
- Probe the origin and evolution of life on Earth and determine if life exists elsewhere in our solar system
- Chart our destiny in the solar system

RESEARCH FOCUS AREAS

- Determine the evolution of the heliosphere and its interaction with the galaxy
- Discover how magnetic fields are created and evolve and how charged particles are accelerated
- Understand coupling across multiple scale lengths and its generality in plasma systems
- (b) Delineate the current state of the local interstellar medium and its implications for galactic evolution
- (c) Determine the interaction between the interstellar medium and the astrospheres of the Sun and other Stars
- (b) Search for molecules and the building blocks of life from comets, Kuiper Belt objects, and dust in the Heliopshere and the interstellar medium
- (a) Explain the role of varying solar activity in the future terrestial climate and habitability

HIGO SCIENCE MISSION

HIGO's QUEST

HIGO is our first step into the interstellar medium and a window into galactic evolution

HIGO SCIENCE OBJECTIVES

PRIMARY SCIENCE

Image the global interaction between the interstellar medium and the solar wind that forms the global heliosphere and its boundaries

Discover the current state of the local interstellar medium and explore its implications for galactic evolution

SECONDARY SCIENCE

Contribute to our understanding of the 3-Dheliosphere by monitoring the evolution of the solar wind, pickup ions, and energetic particles beyond Earth's orbit

Search for molecules and the building blocks of life from comets and dust in the heliosphere and interstellar medium

STRAWMAN PAYLOAD

Instrument	Mass (kg)	Power (w)	Data Rate 1.6-3 AU (bps)	Data Rate 3 AU (bps)
ENA Imager	9.5	5	200	200
Heliospheric EUV Spectrometer	16	8	2	0.2
Pickup Ion Spectrometers	16	14	100	50
Neutral Detectors	10.5	3.7	258	223
Radio and Plasma Wave	4.3	4	200	100
Solar UV	0.5	2.1	10	5
Magnetometer with boom	3.3	2.5	500	50
Solar Wind Ions with composition	6.5	6	600	100
Solar Wind e-	2.5	2	150	100
EPD - LO	2	1.3	1000	150
EPD - HI	4	3.1	100	50
DPU	6.8	8.5	30	30
TOTAL	81.9	60.2	3150	1058.2

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